Mobile Malware Madness and How to Cap the Mad Hatters

A Preliminary Look at Mitigating Mobile Malware

Gerry Eisenhaur, Michael N. Gagnon, Tufan Demir, Neil Daswani

Mobile Malware Madness: Recent Case Studies

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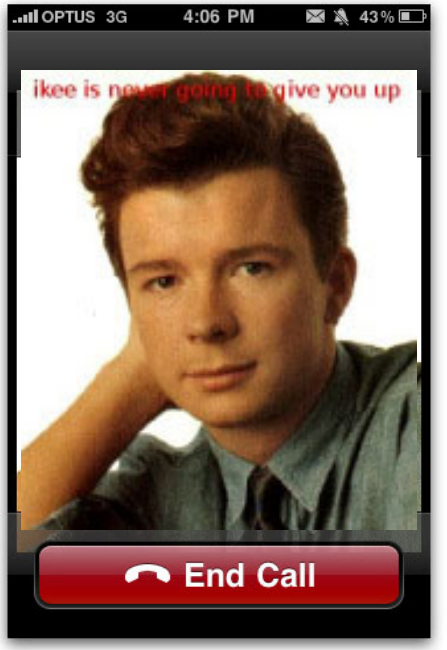
- DroidDream (Android)
  - Over 50 root'ed apps uploaded to Google app marketplace
  - Conducts data theft; send credentials to attackers
- Ikee.A (iOS)
  - Experiment; changed wallpaper to Rick Astley image
  - Worm capabilities (targeted default ssh pwd)
  - Worked only on jailbroken phones with ssh installed (could have been worse)



- Zitmo (Symbian, BlackBerry, Windows Mobile)
  - Captures mTANs from SMS messages; aimed at defeating 2-factor auth
  - Works in conjunction with Zeus botnet; sent in conjuction with user PC infection
  - Propagates via SMS; claims to install a "security certificate"

Behavioral Analysis

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- What is Behavioral Analysis?
  - Run applications to see what they do – assess their “behavior”
  - Look at “what the code does” not “what it looks like”

- Why Behavioral Analysis? Answer questions such as:
  - What domains and/or IPs are accessed via the network at run-time, and what is the access pattern?
  - How many entries in the address book are accessed? Is each entry or some threshold number of entries accessed? Are all or some significant number of entries accessed serially, or is the access pattern random?
  - Are the accessed address book entries sent over the network? Is sensitive data or PII leaked?

Behavioral & Signature-Based Detection: Working together

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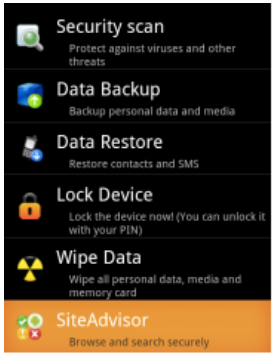
- Behavioral and signature-based detection are ***complementary***
  - Behavioral detection on a client will suck battery life – should be done “in the cloud” / on a server
  - Behavioral analysis can provide signatures to client-side anti-virus

Cloud-Based
Behavioral Scanning

Total Infections Catalogued:

Auto-generate
signatures

Client-Side
Signature Check



Principles for Mobile Malware Detection

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- **Malware becoming ever more sophisticated and mutable → Must use behavioral detection approaches**
  - Malware variations growing exponentially
  - Easy for criminals to distribute malware
  - Combination of static/signature-based and behavioral approaches needed
- **Some combination of cloud-based analysis + client side protection necessary**
  - Limited resources (CPU, memory) on the endpoint to analyze content (URLs) and applications in real-time
  - Problem compounded on mobile devices
  - Perform analysis in the cloud; prevent and remediate on the client (and/or edge)
- **Take advantage of massive amounts of data**
  - Build libraries of millions of mobile apps over time, each behaviorally analyzed for malicious behavior

Behavioral Study of 10K Android Apps

- 10K apps chosen at random from 30 different categories on Google Android Marketplace
- Analyzed in an emulator for 30 seconds
- Minimal simulated user interaction (although we could have done more)
- Found / Studied:
  - Privacy violations: IMEI / IMSI Leakage
  - Network access / Traffic patterns
  - Bandwidth usage
  - SMS activity
  - System call activity

8.4% of Android Apps Leaking Personal Information (IMEI)

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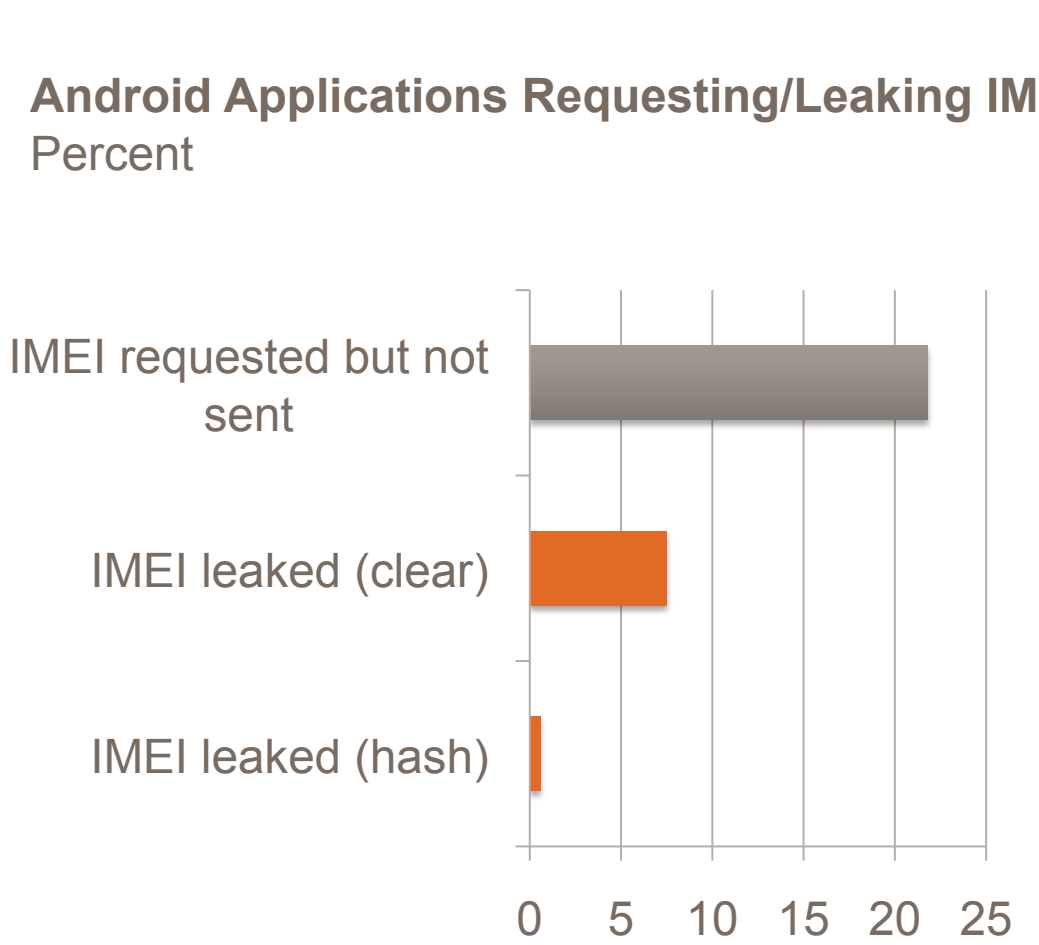

- Static analysis approaches would only identify that IMEI was requested; however, cannot tell if the IMEI was actually leaked
- Static analysis only could yield “false positives”
- Dasient has forensic evidence that the IMEI was leaked in 8.4% of the apps

Source: Dasient (n=10,000)

Network Behavior

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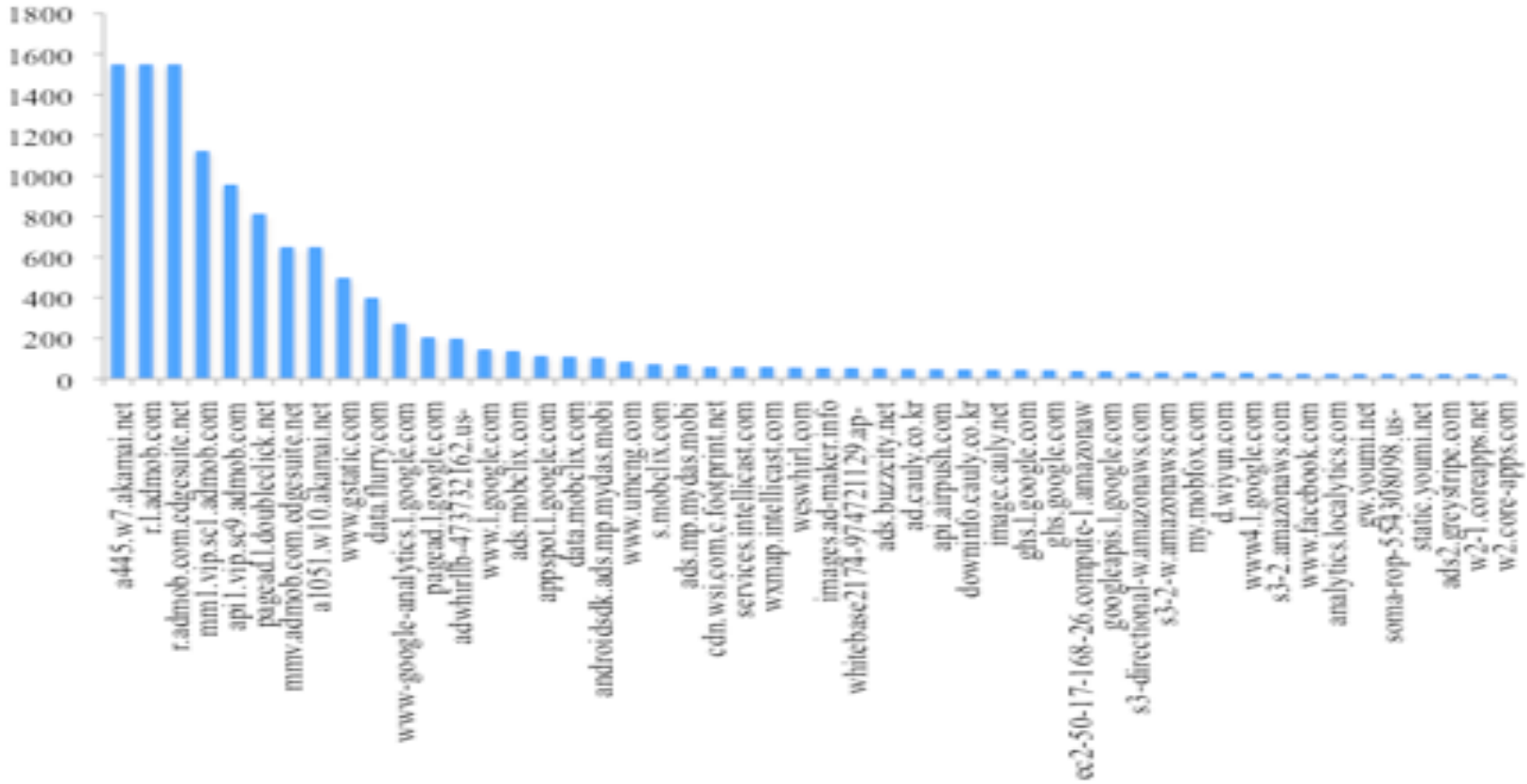
Top 50 Domains Accessed by Android Apps



Source: Dasient (n=10,000)

System Call Activity

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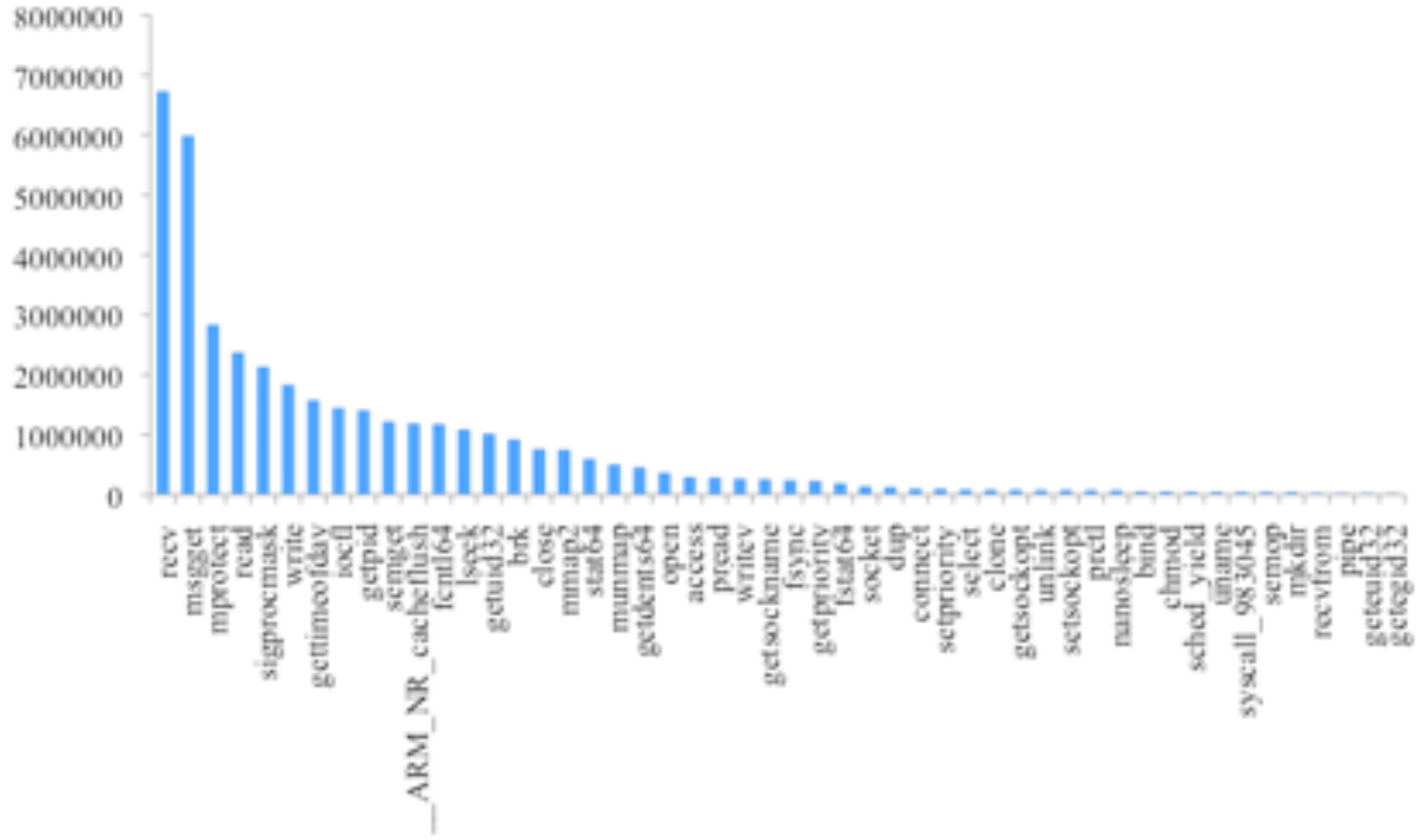
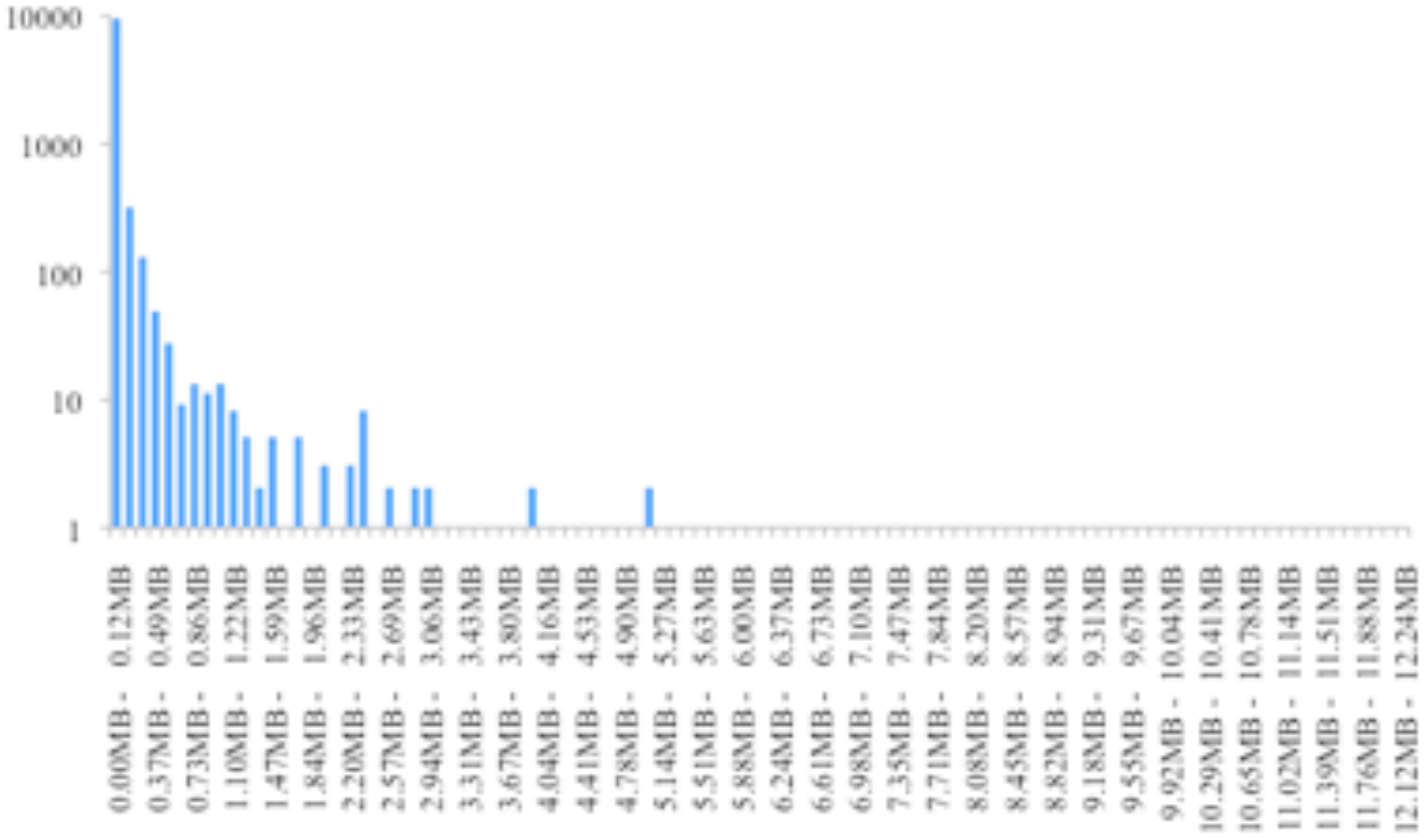
Top System Calls Made by Android Apps



Source: Dasient (n=10,000)

Bandwidth Usage

Bandwidth Usage of Android Apps



Source: Dasient (n=10,000)

Ex. Behavioral Signals for Malware Detection

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- Hundreds of these
- Example #1: Number of processes
  - Baseline: 58.3, Std Dev: 4.5
  - DroidDream: 660.3 (due to “rageagainstthecage”), Std Dev: 238.8
- Example #2: Undesired SMS activity

Name	# of msgs	Number
Fakeplayer.A	3	3353, 3354
Fakeplayer.B	4	7132
Fakeplayer.GEN	4	7132
Bgserv.A	1	10086
Twalkupi.A	# of contacts	contacts

Mobile Drive-bys

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- No social engineering or user interaction required to compromise device; just visit a web page
- Smart phones are vulnerable, valuable, and use common software packages (e.g., Webkit)

- Prototype attack: Drive-by data ex-filtration – steal Skype Ims
  1. User visits compromised web page
  2. Exploit WebKit vuln CVE-2010-1807
  3. Attacker connects to device via backdoor
  4. Find Skype username
  5. Exploit Skype vuln CVE-2011-1717
  6. Traverse to user's Skype data directory
  7. Send files to attacker's machine
  8. Run SQLite locally & read user's convos

Notification: Privacy Violation

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Ninja Slider

Scanned on **July 21 2011** at **9:17 AM EST** from **Android App Store**

Notification: Privacy Violation

Application leaks MD5 hash of user's IMEI number in GET request
(5284047f4ffb4e04824a2fd1d1f0cd62). Hashes of IMEI numbers are reversible (more information).

GET /sp/load_app_ads?
deviceOsVersion=2.3&deviceName=generic&sdkBuild=109&deviceFamily=google_sdk&deviceBrand=generic&
deviceClass=android&appIdentifier=cross.field.NinjaSlider&udid=**5284047f4ffb4e04824a2fd1d1f0cd62**&
deviceOsVersionFull=2.3.4&sdkVersion=1.2.2&callbackid=0&zid=NjY3OA%253D%253D%250A&adl_app_flg=1&
displaySize=480x800&displayDensity=1.5 HTTP/1.1
Host: sp.ad.adlantis.jp

Domains / IPs accessed

a1621.b.akamai.net	80.150.193.42
i.adimg.net.edgesuite.net	80.150.193.27
vatan.adlantis.jp	59.106.159.228

Related permissions
android.permission.READ_PHONE_STATE

Publisher
Cross Field Inc.

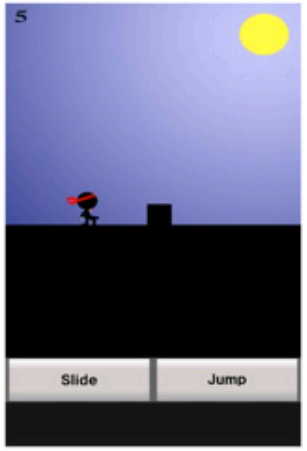
Version
1.2.7

Last Update
7/20/2011

Package name
cross.field.NinjaSlider

SHA1 Hash
22eb1493275efdbff68e8bab58af1e3d60f03fcc

Screenshot



Alert: Malware (DroidDream)

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Bowling Time

Scanned on **March 10 2011** at **2:58 PM EST** from **Android App Store**

Attempt to take root access via rageagainstthecage exploit

Direct access to IP: 184.105.245.17

Domains / IPs accessed

184.105.245.17
a96-17-109-112.deploy.akamaitechnologies.com
api1.vip.sc9.admob.com
adwhirllb-473732162.us-east-1.elb.amazonaws.com

Permissions Requested

Permission		Description
ACCESS_WIFI_STATE	View Wi-Fi status	Allows an application to view the information about the status of Wi-Fi.
CHANGE_WIFI_STATE	Change Wi-Fi status	Allows an application to connect to and disconnect from Wi-Fi access points and to make changes to configured Wi-Fi networks.
INTERNET	Full Internet access	Allows an application to create network sockets.
READ_PHONE_STATE	Read phone state and identity	Allows the application to access the phone features of the device. An application with this permission can determine the phone number and serial number of this phone, whether a call is active, the number that call is connected to and so on.

Public Activities Without Permissions (1)

com.android.root.main

Publisher
Kingmall2010

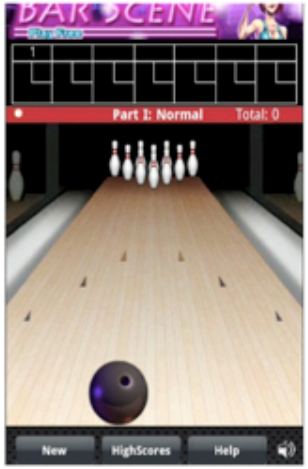
Version
(Unknown)

Last Update
(Unknown)

Package name
com.droiddream.bowlingtime

SHA1 Hash
72adcf43e5f945ca9f72064b81dc0062007f0fbf

Screenshot



Summary + Q&A

- Significant growth in mobile malware in past two years
- Behavioral analysis can complement static analysis to identify mobile malware
- Studied 10K Android apps + malware
  - Identified IMEI / IMSI leaks
  - Undesired SMS
  - Identified behavioral signals of malware
- Prototyped mobile drive-by attack

- We're Hiring! Contact us at careers@dasient.com